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General Notes.

PETROGRAPHY.[1]

Examples of Rock Differentiation.—Yogo Peak in the Little Belt Mountains, Montana, consists of a stock of massive igneous rock which breaks up through surrounding horizontal sediments, that have been metamorphosed on their contact with the eruptive. A vertical section through the south face of the mountain caused by a branch of Yogo Creek has afforded Weed and Pirsson[2] and excellent opportunity to study the relations of different phases of the eruptive to one another. The massive rock shows a constant variation and gradation in chemical and mineralogical composition along its east and west axis which is two miles in length. In its eastern portion the rock is a syenite, containing pyroxene, hornblende, biotite, orthoclase, oligoclase, quartz and a few accessories. The pyroxene is a pale green diopside and the hornblende a brownish-green variety. The latter is thought to be paramorphic after the former. In structure the syenite is hypidiomorphic with a tendency toward the allotriomorphic structure. Further west, about in the center of the mass, the syenite changes to a darker gray rock with a tinge of green, somewhat resembling a diorite. It is more coarsely crystalline than is the syenite and is much more basic. The minerals are the same as in the syenite, except that quartz is lacking, but differ somewhat in their character and in the proportions present in the two rocks. The augite is now a bright green idiomorphic mineral. Hornblende is rare and biotite abundant. The great difference between this rock, which the authors call yogoite, and the syenite, is in the relative proportions of augite and orthoclase present in them. In the yogoite the pyroxene predominates over the orthoclase, while in the syenite the reverse ratio exists. In the western portion of the rock mass, the prevailing type is shonkinite, a very dark basic rock, very similar to that of Square Butte.[3] Augite and biotite are very abundant as compared with the orthoclase, which in turn predominates over plagioclase. This latter mineral is represented by andesine, a more basic feldspar than that in either the syenite or the yogoite. Analyses of the three types of Yogo Peak rocks follow:

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[1] Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

[2] Amer. Journ. Sci., Vol. L, 1895, p. 467.

	SiO_2	TiO_2	Al_2O_3	Cr_2O_3	Fe_2O_3	FeO	MnO	MgO	CaO	BaO	SrO	Na_2O	K_2O	H_2O	P_2O_5		Total
Syenite	61.65	.56	15.07	tr	2.03	2.25	.09	3.67	4.61	.27	.10	4.35	4.50	.67	.33	=	100.15
Yogoite	54.42	.80	14.28	tr	3.32	4.13	.10	6.12	7.72	.32	.13	3.44	4.22	.60	.59	=	100.19
Shonkinite	48.98	1.44	12.29	tr	2.88	5.77	.08	9.19	9.65	.43	.08	2.22	4.96	.82	.98	=	99.77

Shonkinite contains in addition .22 per cent. of Fl.

From a consideration of the nature of the three types of rock the authors conclude that the Yogo Peak stock exhibits the results of a progressive differentiation along its major axis. There is a progressive increase in the ferro-magnesian constituents from the east to the west and a consequent increase in basicity. All the components of the three types exhibit the effects of this differentiation in the proportions present in the different rocks. The Yogo Peak mass is thus an illustration of a "Facies suit" as distinguished from a "rock series." In the former differentiation took place in situ, whereas in a 'rock series' differentiation occurred before the eruption of rocks into their existing positions. The facies suit of Yogo Peak together with the rocks of neighboring mountains comprise a distinct rock series.

The authors close their paper with an appeal for a more specific nomenclature in petrography—a nomenclature that will take account not only of the qualitative relations between the minerals that make up rock masses but of the quantitative relations as well. The Yogo Peak rocks form a natural series with sanidinite and peridotites. Rocks composed of orthoclase and no augite = sanidinite; when orthoclase exceeds augite = augite-syenite; when orthoclase equals augite = yogoite; when augite exceeds orthoclase = shonkinite; when augite alone is present = pyroxenite and peridotite. In this scheme the term augite includes also other ferro-magnesian minerals, and the terms orthoclase other feldspars.

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[3] Compare AMERICAN NATURALIST, 1895, p. 737.

In connection with the article above referred to Iddings[4] mentions the existence of a series of rocks associated with typical basalts and andesites in the Yellowstone National Park. They represent like phases of differentiation belonging to separate, but similar rock families. Most all of these rocks are basaltic looking. They occur in flows and dykes and sometimes as breccias, constituting the major portion of the Absaroka Range. These rocks present a wide range of composition within definite limits, forming a series connected by gradual transitions. Three classes are distinguished, the first of which is characterized usually by abundant phenocrysts of olivine and augite and an absence of feldspar phenocrysts; the second class is characterized by the presence of labradorite phenocrysts in addition to those of olivine and augite, and the third class by the presence of labradorite phenocrysts. The names given to the three classes are absarokite, shoshonite and banakite. The distinctions between the classes is based principally upon their chemical relationships. A large number of analyses, most of which were taken from other papers, illustrate their points of difference. A comparison of the analyses, besides showing the close relationships existing between the rocks of the three classes, shows also what mineralogical differences may obtain for rocks of the same chemical composition. The shoshonite from the base of Bison Peak and the banakite from Ishawooa Canyon have practically the same chemical composition. The former, however, contains abundant phenocrysts of labradorite, augite and olivine, while the latter contains numerous labradorite phenocrysts, but few and small ones of the other two minerals. The groundmass of the first shows much less orthoclase than that of the second, and no biotite, which abounds in the second. The author compares the series of rocks studied by him with the series studied by Merrill[5], with the series discussed by Weed and Pirsson and with Brögger's[6] grorudite-tinguaite series. The conclusion reached by this comparison is to the effect that it may be doubted whether the genetic relations between igneous rocks can properly mark the lines along which a systematic classification of them may be established.

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[4] Journal of Geology, Vol. III, p. 935

[5] Cf. AMERICAN NATURALIST, 1896, p. 128.

[6] Cf. AMERICAN NATURALIST, 1895, p. 567.

Petrographical Notes.—In a phyllite-schist found in blocks on the south shore of Lake Michigamme in Michigan, Hobbs[7] has discovered large crystals of a chloritoid like that described by Lane, Keller and Sharpless in 1891. The rock in which the crystals occur is a mass of colorless mica scales through which are distributed large flakes of biotite, small blades of chloritoid, a few acicular crystals of tourmaline and grains of magnetite. Most of the chloritoid is in large porphyritic crystals imbedded in this matrix. The optical properties of the mineral correspond to those of masonite.

In a summary of the results of this work in the upper Odenwald Chelius announces the existence there of two granites—the younger a fine grained aplitic variety and the older a coarse grained porphyritic variety, with a parallel structure due to flowage. Pegmatitic veins that cut this granite are looked upon as linear accumulations of porphyritic feldspar crystals. Many notes are also given on the diorites, gabbros and basalts of the Odenwald, on the basic enclosures in the granite, which the author regards as altered fragments of foreign basic rocks, but nothing of a startling nature with reference to these subjects is recorded. A gabbro porphyry was found occurring as a dyke mass. It consists of phenocrysts of labradorite in a gabbro-aplitic ground mass.

In a general paper on the divisibility of the Laurentian in the Morin area N. W. of Montreal, Canada, Adams[8] describes the characteristics of the members of the Grenville series of gneisses, quartzites and limestones. The augen gneisses, the thinly foliated gneisses and the granulites of the series are all cataclastic or granulitic in structure. They are regarded as squeezed igneous rocks. The crystalline limestones and quartzites are recrystallized rocks that are thought to be changed sedimentaries. Pyroxene gneisses, pyroxene granulites and other allied rocks are of doubtful origin. In addition to all these rocks there is present in the series a group of peculiar banded garnetiferous gneisses which from their chemical composition are regarded as in all probability metamorphosed sedimentary rocks.

[7] Amer. Jour. Sci., Vol. L, 1895, p. 125.

[8] Amer. Jour. Sci., Vol. L, 1895, p. 58.